DEPARTMENT of AGRICULTURE and NATURAL RESOURCES
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RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT APPLICATION NO. 8755-3, C. H. Rau

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Agriculture and Natural Resources concerning Water Permit Application No. 8755-3, C. H. Rau, 12553 309th Avenue, Selby SD 57472.

The Chief Engineer is recommending APPROVAL of Application No. 8755-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing domestic water uses and water rights, 3) the proposed use is a beneficial use and 4) it is in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board with the following qualifications:

1. The wells approved under Water Permit No. 8755-3 are located near domestic wells and other wells which may obtain water from the same aquifer. Water withdrawals shall be controlled so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.

2. If wells authorized by Permit No. 8755-3 require replacing, any new well shall be constructed by a licensed well driller and construction of the well and installation of the pump shall comply with Water Management Board Well Construction Rules, Chapter 74:02:04 with the well casing pressure grouted (bottom to top) pursuant to Section 74:02:04:28.

3. Pursuant to SDCL 46-5-6 which allows a greater diversion rate if the method of irrigation, time constraints, or type of soils so requires, Permit No. 8755-3 authorizes a maximum diversion rate of 4.45 cfs for the irrigation of 246 acres with an annual volume not to exceed 2 acre feet of water per acre per year.

4. This Permit is approved subject to the irrigation water use questionnaire being submitted each year.

See report on application for additional information.

Eric Gronlund

Eric Gronlund, Chief Engineer
June 26, 2023

NOTE: The existing wells are about 50 years old and likely have not been in use for a long time. If the wells cannot be brought back into service, any replacement wells need to be completed as set forth in qualification No. 2. Furthermore, if any of the existing wells are abandoned, they need to be plugged in accordance with the well construction standards.

Report to the Chief Engineer

On Water Permit Application No. 8755-3

C. H. Rau

June 20th, 2023

Water Permit Application No. 8755-3 proposes to appropriate 4.45 cubic feet per second (cfs) from three existing wells completed into the Selby aquifer (75 feet deep) located in the N ½ Section 11 for irrigation of 246 acres located in the N ½ Section 11; all in T124N-R76W. The applicant is requesting a diversion rate greater than the statutory limit of 1 cfs per 70 acres. The site of interest is located approximately 5 miles north of Selby, SD in Walworth County.

AQUIFER: Selby (S)

HYDROGEOLOGY:

The Selby aquifer is a Quaternary aged glacial outwash that consists of fine to coarse sand and gravel (Kume and Howells, 1987). In Campbell, Walworth, and McPherson Counties, the Selby aquifer is estimated to underly approximately 170,900 acres and contain approximately 605,000 acre-feet of recoverable water in storage (Hedges et al, 1982). The Selby aquifer is hydrologically connected to surface water features such as the Blue Blanket Lake, Sand Lake, and Salt Lake (Koch, 1970; Kume and Howells, 1987). In Walworth County, the average saturated thickness of the Selby aquifer is 18 ft (Kume and Howells, 1987). The Selby aquifer is predominantly under unconfined conditions, but there are a few areas that are confined by clay layers (Hedges et al, 1982).

A water well completion report was not submitted with Water Permit Application No. 8755-3. A nearby water well completion reports will be used instead to evaluate local aquifer conditions. A well report for canceled Water Permit No. 4173-3A is located in the same approximate area as this application and completed on May 4th, 1982. The well is completed into the Selby aquifer and has a depth to the top of aquifer material of 55 feet below the ground surface, static water level of 37 feet 11 inches below the ground surface, and saturated aquifer thickness of 15 feet at the time of well completion (Water Rights, 2023d). This well seems to be under confined conditions, however there are multiple nearby water well completion reports that suggest the Selby aquifer to be under unconfined conditions. Another nearby well is located approximately 0.47 miles northwest of the diversion points and was completed on September 13th, 1987. This well is completed into the Selby aquifer and has a depth to the top of aquifer material of 4 feet below the ground surface, static water level of 15 feet below the ground surface, and saturated aquifer thickness of 50 feet at the time of well completion (Water Rights, 2023d). Based on the water well completion reports near the diversion points, the Selby aquifer is expected to behave under unconfined conditions at the diversion points (SDGS, 2023; Water Rights, 2023b and 2023d).

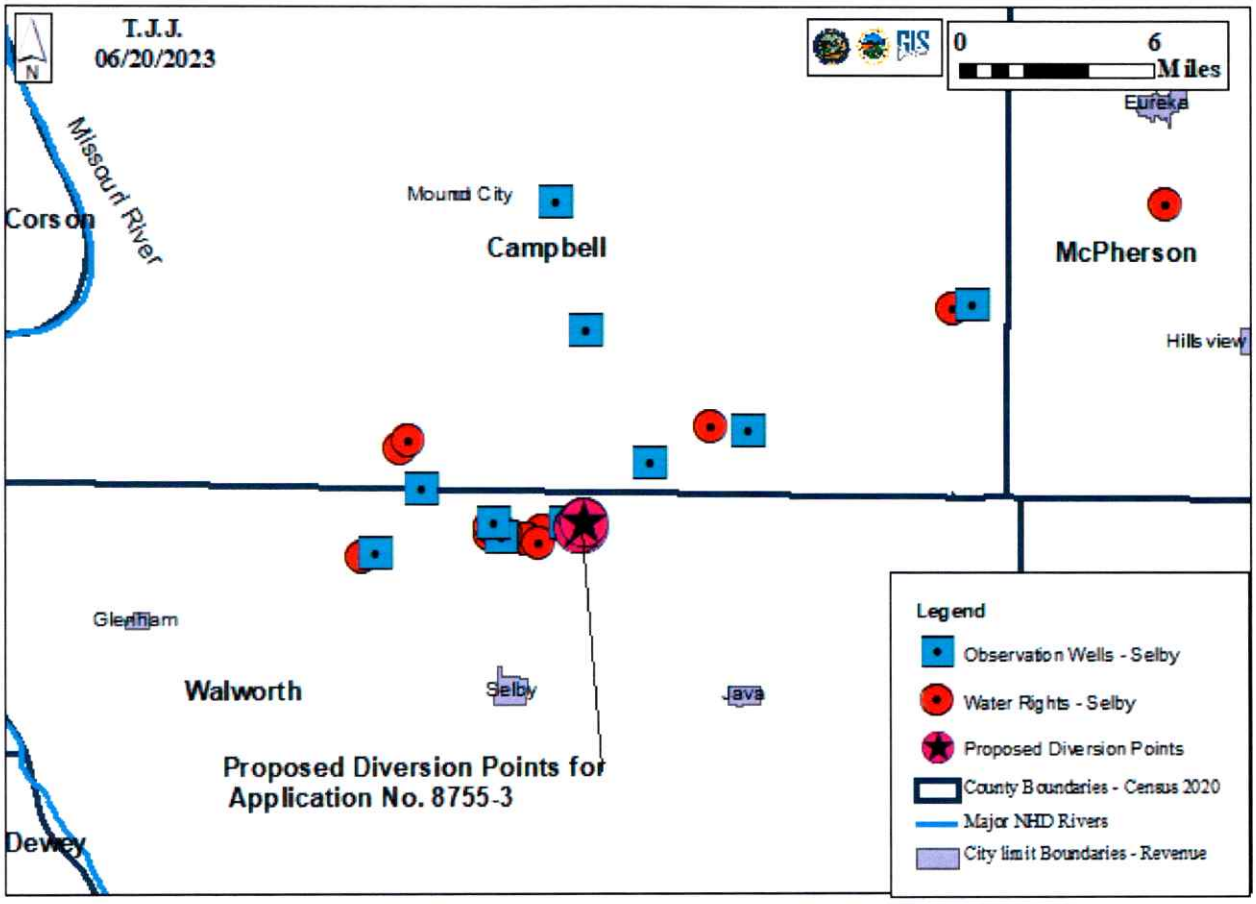

Figure 1. The location of water rights/permits and observation wells in the Selby aquifer (Water Rights, 2023b) and diversion points for Water Permit Application No. 8755-3.

South Dakota Codified Law (SDCL) 46-2A-9

Pursuant to SDCL 46-2A-9, "A permit to appropriate water may be issued only if there is a reasonable probability that unappropriated water is available for the applicant's proposed use, the proposed diversion can be developed without unlawful impairment of existing domestic water uses and water rights, the proposed use is a beneficial use, and the permit is in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board as defined by §§ 46-2-9 and 46-2-11." This report will address the availability of unappropriated water and the potential for unlawful impairment of existing domestic uses and water rights within the Selby aquifer.

WATER AVAILABILITY:

Water Permit Application No. 8755-3 proposes to appropriate water from the Selby aquifer for irrigation use. The probability of unappropriated water being available from the aquifer can be evaluated by considering SDCL 46-6-3.1, which requires "No application to appropriate groundwater may be approved if, according to the best information reasonably available, it is probable that the quantity of water withdrawn annually from a groundwater source will exceed

the quantity of the average estimated annual recharge of water to the groundwater source. An application may be approved, however, for withdrawals of groundwater from any groundwater formation older than or stratigraphically lower than the greenhorn formation in excess of the average estimated annual recharge for use by water distribution systems." The Selby aquifer is not older than or stratigraphically lower than the Greenhorn Formation, and the applicant's proposed use is not for use in a water distribution system as defined by SDCL 46-1-6(17). Therefore, the average annual recharge and average annual withdrawal rates to and from the Selby aquifer must be considered.

HYDROLOGIC BUDGET:

Recharge

Recharge to the Selby aquifer is received primarily by infiltration of precipitation, via snow melt and spring/early summer months rains (Koch, 1970). During the summer months most of the rainfall does not reach the water table because it is held as soil moisture until it is removed by evapotranspiration (Koch, 1970). To recharge the aquifer, there must be enough rainfall to exceed the soil moisture holding capacity so that any additional infiltrating rainfall will contribute to the recharge of the underlying aquifer (Koch, 1970).

Using observation well analysis Hedges et al (1985) estimated a recharge rate of 2.0 inches per year for the unconfined portions of the Selby aquifer. The Selby aquifer has an estimated areal extent of approximately 170,900 acres (Hedges et al, 1982). Therefore, the average annual recharge rate (based on Hedges et al, 1982 and 1985) is approximately 28,483 acre-feet/year. It is likely this value is somewhat greater than the actual recharge because there are some minor portions of the aquifer that are confined.

Discharge

Discharge from the Selby aquifer in South Dakota primarily occurs through well withdrawals and evapotranspiration in areas where the aquifer is at or near land surface (Koch, 1970). Currently, there are 13 water rights/permits authorized to appropriate water from the Selby aquifer (Water Rights, 2023c). There are no future use permits reserving water from the Selby aquifer (Water Rights, 2023c).

Table 2 summarizes the 3 non-irrigation water rights/permits authorized to appropriate water from the Selby aquifer with the estimated annual use for each water right/permit as determined by their limiting diversion rate or annual volume. The amount of water that can be withdrawn was estimated by assuming the non-irrigation water rights/permits limited by an annual volume will withdraw their entire appropriated volume every year. It is estimated that non-irrigation water rights/permits limited only by a diversion rate will pump at their maximum permitted diversion rate for 60% of the time. The 60% estimation was established by Water Rights Staff to be a reasonable and safe estimate of average annual withdrawals by non-irrigation appropriations. Historically, the 60% estimate has been accepted by the Water Management Board. Many municipalities may also source their water from other rural water systems. The City of Selby sources 100% of their water from another system and the City of Eureka sources 74%

of their water from another system (Drinking Water, 2023). Assuming the 60% estimate will apply to the remaining 26% from the City of Eureka, the average annual withdrawal rate for the Selby aquifer non-irrigation water rights/permits is approximately 151 acre-feet/year (Table 2) (Water Rights, 2023c).

Table 2. Estimated annual use for non-irrigation water rights/permits authorized to divert water from the Selby aquifer (Water Rights, 2023c)

Permit No.	Name	Status	Uses	Authorized Diversion Rate (cfs)	Authorized Annual Volume (acre-feet)	Estimated Use (acre-feet/year)
2249-3	CITY OF EUREKA	LC	MUN	1.34	N/A	151.3
781-3	CITY OF SELBY	LC	MUN	0.78	N/A	0
837-3	CITY OF SELBY	LC	MUN	0.78	N/A	0
LC Licensed Water Right, MUN Municipal					**TOTAL:**	**151**

Currently, there are 10 irrigation water rights/permits appropriating water from the Selby aquifer (Water Rights, 2023c). Irrigation water rights/permits have been typically required to report their annual usage on an irrigation questionnaire since 1979. The average annual withdrawal rate for the Selby aquifer irrigation water rights/permits that have reported over the period of record (1979 to 2022) is approximately 1,019 acre-feet per year (Table 3) (Water Rights, 2023a). To reflect the current development of irrigation water rights/permits more accurately, the average annual withdrawal rate for irrigation appropriations from 2012 to 2021 is approximately 1,004 acre-feet per year (Table 3) (Water Rights, 2023a).

This Application (No. 8755-3) is requesting to irrigate 246 acres. Generally, irrigators in eastern South Dakota apply less than one foot of water per acre per year. However, the one foot of water per acre per year application rate will be used to somewhat overestimate the annual withdrawal rate for these irrigation water rights/permits. Therefore, the estimated average annual withdrawal rate for this application is approximately 246 acre-feet per year. Collectively, the average annual withdrawal rate for the irrigation appropriations from 2012 to 2021 (1,004 acre-feet/year), plus this application (246 acre-feet per year), is approximately 1,250 acre-feet per year.

Table 3. Reported historic irrigation use form the Selby aquifer (Water Rights, 2023a)

Year	No. of Permits Reporting	Reported Pumpage (acre-feet)
1979	34	965.00
1980	34	2202.00
1981	37	1740.00
1982	20	1305.85
1983	22	1128.89
1984	34	1445.00
1985	33	2318.00
1986	34	1192.90
1987	26	1478.00
1988	24	2320.00
1989	24	1265.20
1990	25	1119.40
1991	24	835.60
1992	24	590.00
1993	23	119.50
1994	23	1293.85
1995	21	492.66
1996	19	680.09
1997	19	361.00
1998	19	522.44
1999	17	342.48
2000	17	313.43
2001	17	287.32
2002	17	943.59
2003	16	775.66
2004	17	1117.37
2005	16	861.29
2006	15	1402.74
2007	13	1019.51
2008	13	738.39
2009	12	672.59
2010	12	1076.91
2011	12	846.86
2012	12	912.98
2013	12	1257.15
2014	11	782.71
2015	11	904.98
2016	11	1035.05
2017	10	1274.42
2018	10	1089.53
2019	10	259.77
2020	10	1088.58
2021	10	1437.06
Max	37	2320.00
Min	10	119.50
Avg (1979-2021)	**19**	**1019**
Avg (2012-2021)	**11**	**1004**

There are domestic wells completed into the Selby aquifer that do not require a water right/permit, so the withdrawal amount from those wells is unknown (Water Rights, 2023d). Due to their relatively low diversion rates, withdrawals from domestic wells are not considered to be a significant portion of the hydrologic budget. Therefore, the quantity of water withdrawn by domestic wells is estimated to be negligible to the hydrologic budget for the Selby aquifer.

Hydrologic Budget Summary

The average annual recharge rate to the Selby aquifer is approximately 28,483 acre-feet/year (Hedges et al, 1982 and 1985). The average withdrawal rate from the Selby aquifer totals to approximately 1,401 acre-feet/year; (non-irrigation: 151 acre-feet/year; irrigation (avg 2012 to 2021 and this application): 1,250 acre-feet/year). Based on the hydrologic budget, there is a reasonable probability unappropriated water is available from the Selby aquifer for the proposed appropriation.

OBSERVATION WELL DATA:

Administrative Rule of South Dakota (ARSD) 74:02:05:07 requires that the Water Management Board shall rely upon the record of observation well measurements in addition to other data to determine that the quantity of water withdrawn annually from the aquifer does not exceed the estimated average annual recharge of the aquifer.

The DANR-Water Rights Program monitors 10 observation wells completed into the Selby aquifer (Water Rights, 2023b). These observation wells provide data on how the aquifer reacts to regional climatic conditions and local pumping. The 4 closest observation wells to the proposed diversion points are WL-76K (approximately 0.5 miles west), WL-76I (approximately 2.5 miles west), WL-76H (approximately 2.8 miles west), and CA-78O (approximately 2.9 miles northeast) (Water Rights, 2023b). The hydrographs for these observation wells are displayed in Figures 2 to 5 (Water Rights, 2023b). The data points utilized to construct the hydrographs are measurement of the static water level in the observation wells from the top of the well casing. It is worth noting the hydrograph titles display DENR Water Rights Observation Well on the hydrographs when the titles should display DANR Water Rights Observation Well on hydrographs. The data shown on Figures 2 to 5 share a similar trend with most of the other observation wells in the Selby aquifer.

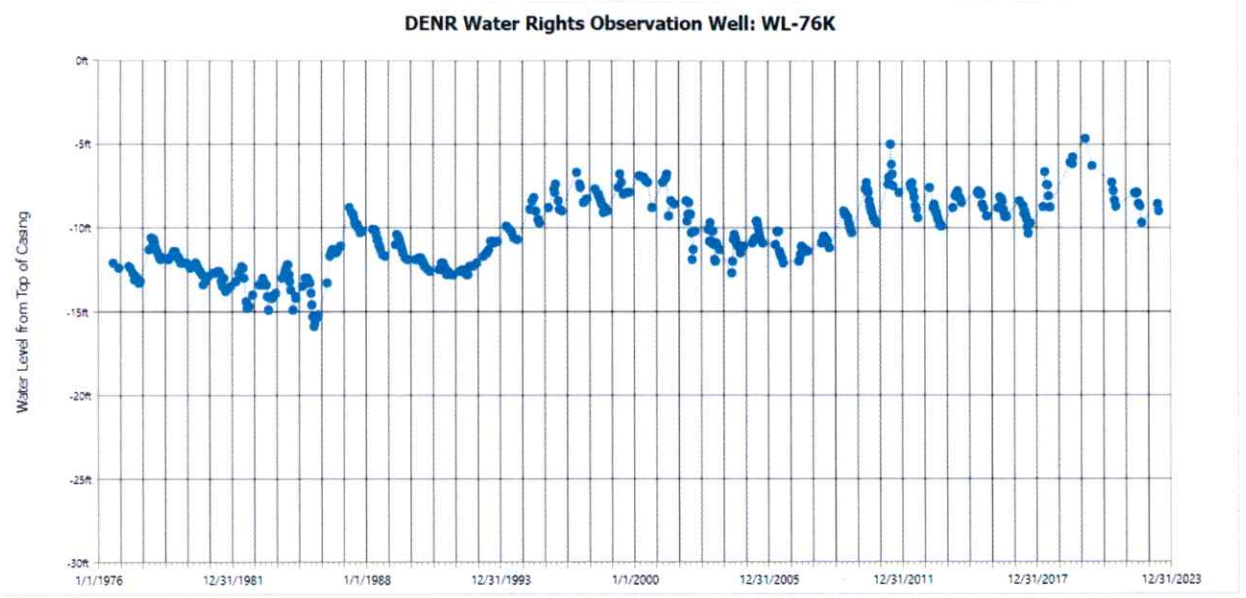

Figure 2. Hydrograph for observation well WL-76K (Water Rights, 2023b)

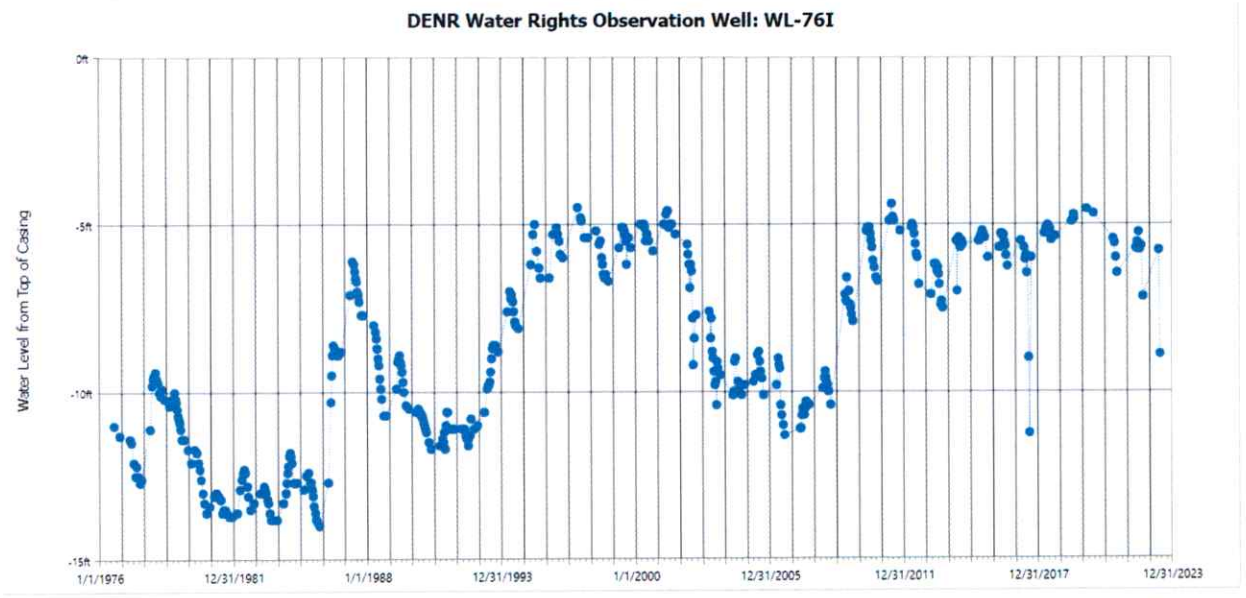

Figure 3. Hydrograph for observation well WL-76I (Water Rights, 2023b)

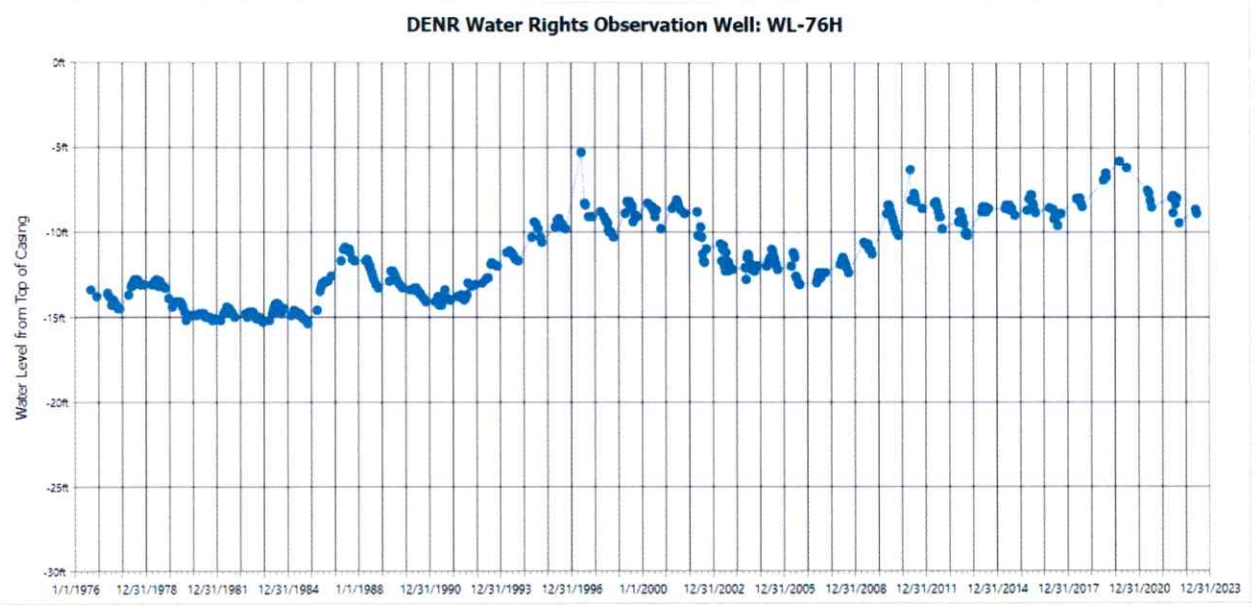

Figure 4. Hydrograph for observation well WL-76H (Water Rights, 2023b)

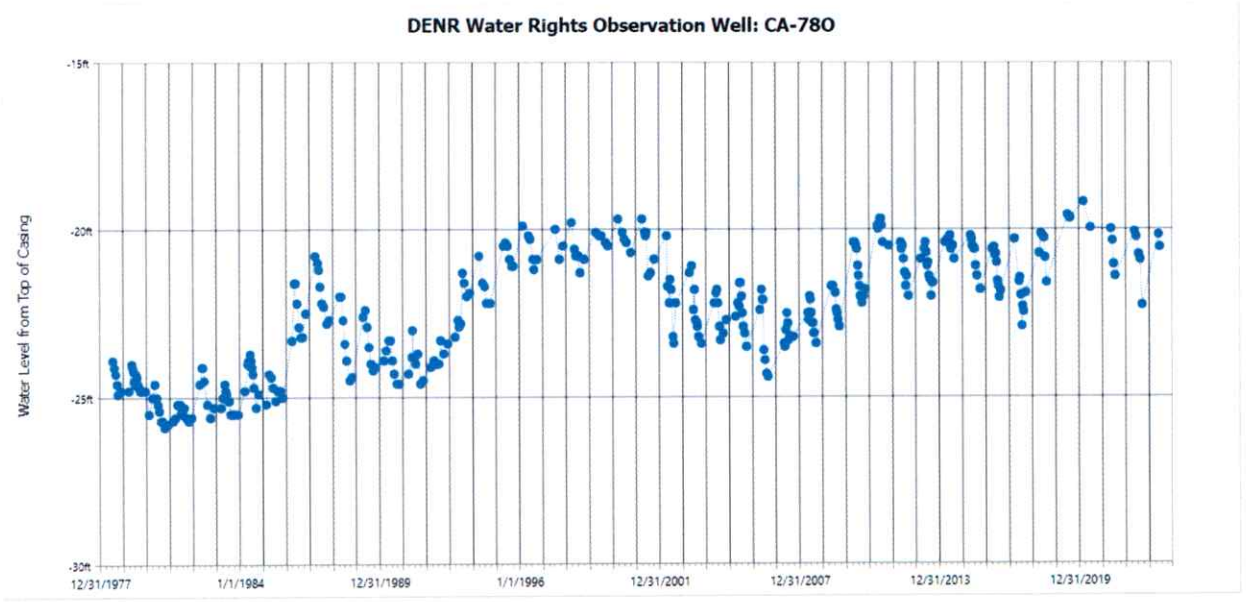

Figure 5. Hydrograph for observation well CA-78O (Water Rights, 2023b)

The hydrographs for the observation wells display generally stable to slightly rising water levels over their respective periods of record. The hydrographs for the Selby aquifer indicate that the aquifer responds well to climatic conditions because water levels are rising during wetter periods (early spring snowmelt and precipitation) and declining to a stable water level during drier periods. Additionally, the water levels in the observation wells display that the amount of recharge to and natural discharge from the aquifer greatly exceeds pumping with the aquifer returning to pre-pumping conditions between irrigation seasons. Aquifer recovery indicates that climatic conditions and therefore, the effects of recharge to and natural discharges from the aquifer govern the long-term fluctuations of waters levels in the aquifer rather than the impacts of pumping from the Selby aquifer. By recognizing that both recharge to and natural discharge

from an aquifer can be captured for pumping, the observation well hydrographs demonstrate unappropriated water is available for the proposed appropriation.

POTENTIAL FOR UNLAWFUL IMPAIRMENT OF EXISTING WATER RIGHTS:

Water rights/permits competed into the Selby aquifer in the general vicinity of the proposed well sites for this application are shown in Figure 6 and summarized in Table 5. The closest water right/permit, not held by the applicant, to the diversion points is Water Permit No. 2772-3, as shown on Figure 6, which is held by Lazy TV Ranch. The diversion point for Water Permit No. 2772-3 is located approximately 1 mile west of the nearest diversion point for this application (Water Rights, 2023c). There are domestic wells on file with the DANR-Water Rights Program that are completed into the Selby aquifer, with the closest domestic well on file (not held by the applicant) approximately 0.4 miles northwest of the nearest diversion point for this application (Water Rights, 2023d). The locations of the domestic wells are provided by the well driller at the time of well completion.

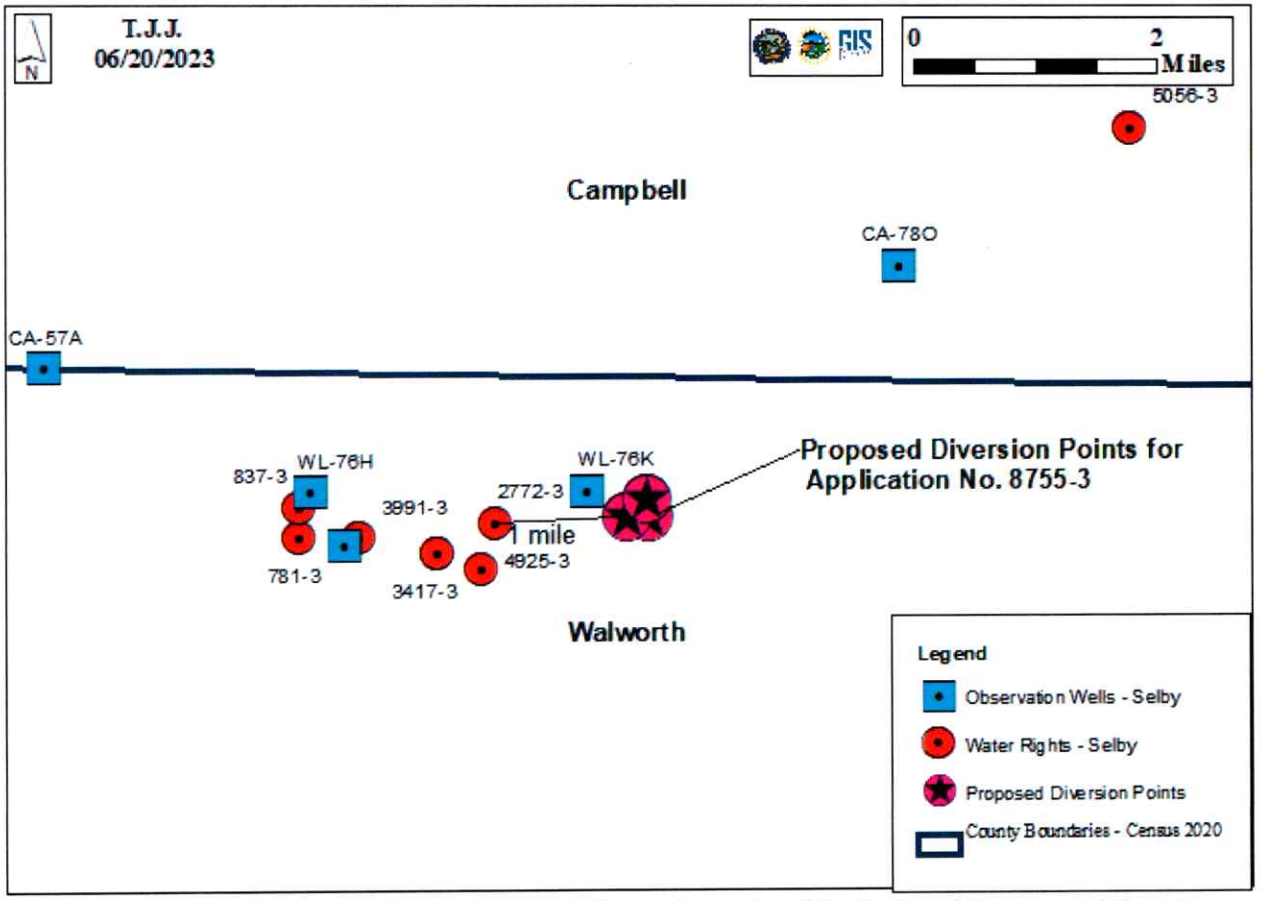

Figure 6. The Selby aquifer water rights/permits and observation wells within 4 miles of the proposed diversion point (Water Rights, 2023c), and the location of proposed diversion points for Water Permit Application No. 8755-3.

Table 4. List of Selby aquifer water rights/permits shown on Figure 6 (Water Rights, 2023c)

Permit	Name/Business	Priority	Status	Use Type	CFS	Acres
781-3	City of Selby	06/07/1961	License	Municipal	0.78	N/A
837-3	City of Selby	10/04/1961	License	Municipal	0.78	N/A
2772-3	Lazy TV Ranch	06/18/1976	License	Irrigation	1.78	124
3417-3	Rory Thorstenson	12/13/1976	License	Irrigation	1.33	124
3991-3	Rory Thorstenson	01/31/1977	Permit	Irrigation	1.93	160
4925-3	Lazy TV Ranch	08/25/1982	License	Irrigation	1.78	130
5056-3	Todd Biel	02/01/1985	License	Irrigation	1.97	138

The Selby aquifer is primarily under unconfined conditions and is expected to be unconfined at the diversion points for this application. In an unconfined aquifer, drawdown created by pumping does not extend far from the pumped well. The Water Management Board recognizes that putting water to beneficial use requires a certain amount of drawdown to occur. The Board has developed rules to allow water to be placed to maximum beneficial use without the necessity of maintaining artesian head pressure for domestic use. The Water Management Board defined an "adversely impacted domestic well" in ARSD 74:02:04:20(7) as:

> "A well in which the pump intake was set at least 20 feet below the top of the aquifer at the time of construction or, if the aquifer is less than 20 feet thick, is as near to the bottom of the aquifer as is practical and the water level of the aquifer has declined to a level that the pump will no longer deliver sufficient water for the well owner's needs."

In Walworth County, the Selby aquifer has an average saturated aquifer thickness of approximately 18 feet (Kume and Howells, 1987). Drawdown is likely to occur in the Selby aquifer, with more drastic drawdowns occurring near the boundary of the aquifer. However, precise drawdown in the aquifer cannot be known without an aquifer performance test. While the best information available indicates that there is a reasonable probability average annual recharge exceeds average annual withdrawals in the aquifer, conditions can occur where withdrawals in the aquifer exceed recharge for a period of time. Situations may occur where pumping from a thicker part of an unconfined aquifer could cause drawdown impacting adequate wells in a thinner part of the aquifer. Under such conditions an unlawful impairment of senior water rights/permits or adequate domestic wells may occur. Therefore, the applicant should control their withdrawals so that nearby adequate domestic wells and senior water rights/permits are able to access needed water. When considering the statutes (SDCL 46-1-4 and 46-6-6.1), rules (ARSD 74:02:04:20(6) and (7)), the saturated aquifer thickness near the diversion point, and the lack of recent well interference complaints for adequate wells completed into the Selby aquifer in Walworth, Campbell, or McPherson Counties, any drawdown created from the diversion is not expected to cause an unlawful impairment on existing water right/permit holders or domestic users with adequate wells (Water Rights, 2023e). Therefore, there is a reasonable probability that any interference from the proposed appropriation will not impose unlawful impairments on existing users with adequate wells.

SDCL 46-5-6:

Pursuant to SDCL 46-5-6, the diversion rate for an irrigation appropriation cannot be in excess of 1.0 cfs per 70 acres or "the equivalent thereof." The statute does provide that: "The Water Management Board may allow a greater diversion, in volume or rate or both, if the method of irrigation, any time constraints on diversion of water, or the type of soil so requires…"

If approved, Water Permit Application No. 8755-3 would authorize a maximum instantaneous diversion rate of 4.45 cfs from one well for the irrigation of 246 acres. The applicant was contacted for the reason for requesting 4.45 cfs (2,000 gpm). This is the amount the irrigation supply person indicated is needed to operate both planned center pivots simultaneously.

CONCLUSIONS:

1. Water Permit Application No. 8755-3 proposes to appropriate 4.45 cubic feet per second (cfs) from three existing well completed into the Selby aquifer (75 feet deep) located in the N ½ Section 11 for irrigation of 246 acres located in the N ½ Section 11; all in T124N-R76W. The site of interest is located approximately 5 miles north of Selby, SD.

2. The applicant is requesting a diversion rate greater than the statutory limit of 1 cfs per 70 acres. The reason given was the method of irrigation requires the greater amount.

3. Based on observation well data and the hydrologic budget, there is a reasonable probability that unappropriated water is available from the Selby aquifer to supply the proposed appropriation.

4. There is a reasonable probability that the diversion by Water Permit Application No. 8755-3 will not unlawfully impair adequate wells for existing water rights/permits and domestic uses.

Tyler Jensen
Natural Resources Engineer I
SD DANR - Water Rights Program

Reviewed by:

for Adam Mathiowetz, PE
Natural Resources Engineer IV
SD DANR -Water Rights Program

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